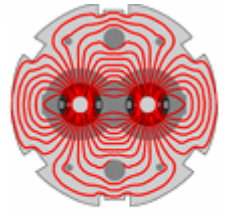




# LHC@FNAL Remote Operations Center

Erik Gottschalk

# Historical Overview

LARP

## Initial concept for LHC remote operations center:

- Dan Green – ROC at Fermilab for CMS test beams, CMS commissioning and operations
- Alvin Tollestrup – remote operations center at Fermilab to apply accelerator expertise in the US to commissioning of the LHC (LARP: LHC Accelerator Research Program)

## LHC@FNAL:

- Charge from Director Witherell (April 14, 2005)
- Kickoff meeting with approx. 30 participants (May 4, 2005)
- "A Vision for Fermilab" presentation to EPP2010 (May 16, 2005) Director Oddone: "Remote control/monitoring/data centers at Fermilab for both accelerator and detector(s)"

# Overview

- What is LHC@FNAL?
- CMS and LHC control rooms at CERN
- Remote operation of CMS
- Plans for ROC & LHC@FNAL
- 3D model of LHC@FNAL
- Summary

http://www.uscms.org/LPC/lpc_roc (ROC web page)
http://cd-amr.fnal.gov/remop/remop.html (LHC@FNAL web page)

# What is LHC@FNAL?

- **A Place**
  - That provides access to information in a manner that is similar to what is available in control rooms at CERN
  - Where members of the LHC community can participate remotely in CMS and LHC activities
- **A Communications Conduit**
  - Between CERN and members of the LHC community located in North America
- **An Outreach tool**
  - Visitors will be able to see current LHC activities
  - Visitors will be able to see how future international projects in particle physics can benefit from active participation in projects at remote locations.

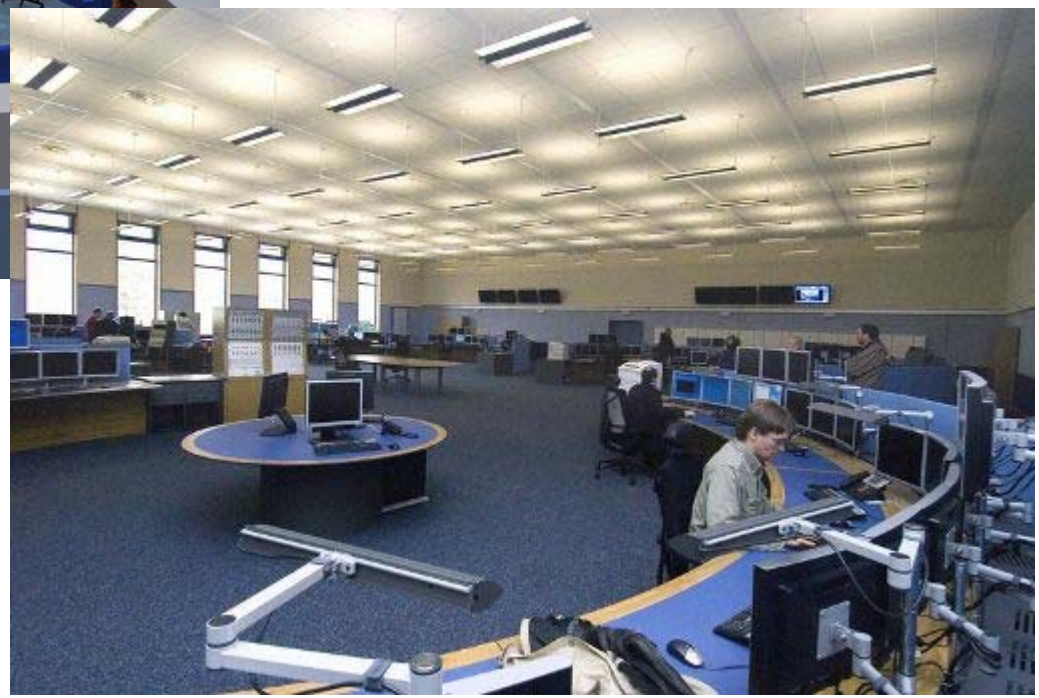
# Control Rooms at CERN

- Temporary **CMS** control room for the Magnet Test Cosmic Challenge (MTCC) – "green barrack"
- **CMS** control room at Point 5
  - Under construction
- **CMS** Control & Analysis Room (CCAR)
  - Future remote operations (and control) center at Meyrin
  - Described as the "heartbeat" of CMS at CERN
- New **LHC** control room – **C**ERN **C**ontrol **C**entre

  The CCC combines all of the control rooms for the accelerators, cryogenic systems and technical infrastructure into one room. The CCC began operations on February 1st, 2006.

# LHC@FNAL – LARP/LHC needs

Model of the CCC at CERN



LHC@FNAL:

- training prior to stays at CERN
- remote participation for studies
- 'service after the sale'

# Remote Operation of CMS

- How will CMS operate?
- This was discussed during CPT Week at CERN, Jan.-Feb. 2006.

Friday 03 February 2006

| CCAR Meeting (2006-02-03 08:30->12:30) | | Chairperson: Paris Sphicas<br>Room: 40-S2-A01 |
|---|---|---|
| 08:30 | Introduction (15') ( transparencies ) | Paris |
| 08:45 | Current plans for CCAR (25') ( more information ) | Hans Hoffmann |
| 09:10 | Infrastructure for CCAR (30') ( more information ) | Werner Jank |
| 09:40 | VRVS: status and future (15') ( more information ) | Philip Galvez |
| 09:55 | Monitoring: Monalisa (15') ( transparencies ) | Iosif Legrand |
| 10:10 | Break | |
| 10:40 | Experience from CDF II Detector Operations (20') ( more information ) | Jeff Spalding |
| 11:00 | CDF Offline Operations (20') ( transparencies ) | Rob Harris |
| 11:20 | Babar offline operations (20') ( transparencies ) | Peter Elmer |
| 11:40 | FNAL Remote Control Room (20') ( more information ) | Kaori Maeshima |

# Remote Operation of CMS

Why does CMS need remote operations at CERN?

- SX5 is ~13 km from Meyrin
- SX5 lacks “infrastructure” available at Meyrin
- CMS control room, currently under construction, is “tiny”
- CMS control room has a low ceiling
- SX5 does not have large and small meeting rooms that are necessary for daily/weekly meetings and expert space

Paris Sphicas:

Asymptotically, at sufficiently long times after startup, we will run CMS remotely

- This is not a question of whether this will happen – it’s a question of when.

# Remote Operations in the U.S.

- The ROC (WH-11) is ready for operations!
- Planning for remote operations for CMS commissioning and operations, and LHC beam commissioning and operations
- Transition from the 11th floor to the 1st floor of Wilson Hall (LHC@FNAL) by Spring 2007
  - More visibility for CMS
  - Joint effort for CMS & LARP
  - Combine commissioning & operations efforts

# ROC (WH-11)

http://www.uscms.org/LPC/lpc_roc

# LHC@FNAL (WH-1)

1) Dedicated facility to support both CMS and LHC commissioning and operations.
   - Remote shifts for CMS

2) Facilitate communication with CMS and LHC control rooms.
   - Call center for US-CMS collaborators to access information about CMS and the LHC accelerator.
   - Introduce collaboration tools to improve communication

3) Take advantage of a unique opportunity to have detector and accelerator experts working together to solve problems.

# LHC@FNAL Task Force

- Erik Gottschalk – Chair (FNAL-PPD)
- Kurt Biery (FNAL-CD)
- Suzanne Gysin* (FNAL-CD)
- Elvin Harms* (FNAL-AD)
- Shuichi Kunori (U. of Maryland)
- Mike Lamm* (FNAL-TD)
- Mike Lamont* (CERN-AB)
- Kaori Maeshima (FNAL-PPD)
- Patty McBride (FNAL-CD)
- Elliott McCrory* (FNAL-AD)
- Andris Skuja (U. of Maryland)
- Jean Slaughter* (FNAL-AD)
- Al Thomas (FNAL-CD)

✓ Task force was charged by the Fermilab Director in April, 2005.

✓ Task force wrote a requirements document and WBS.

✓ Work completed in March, 2006.

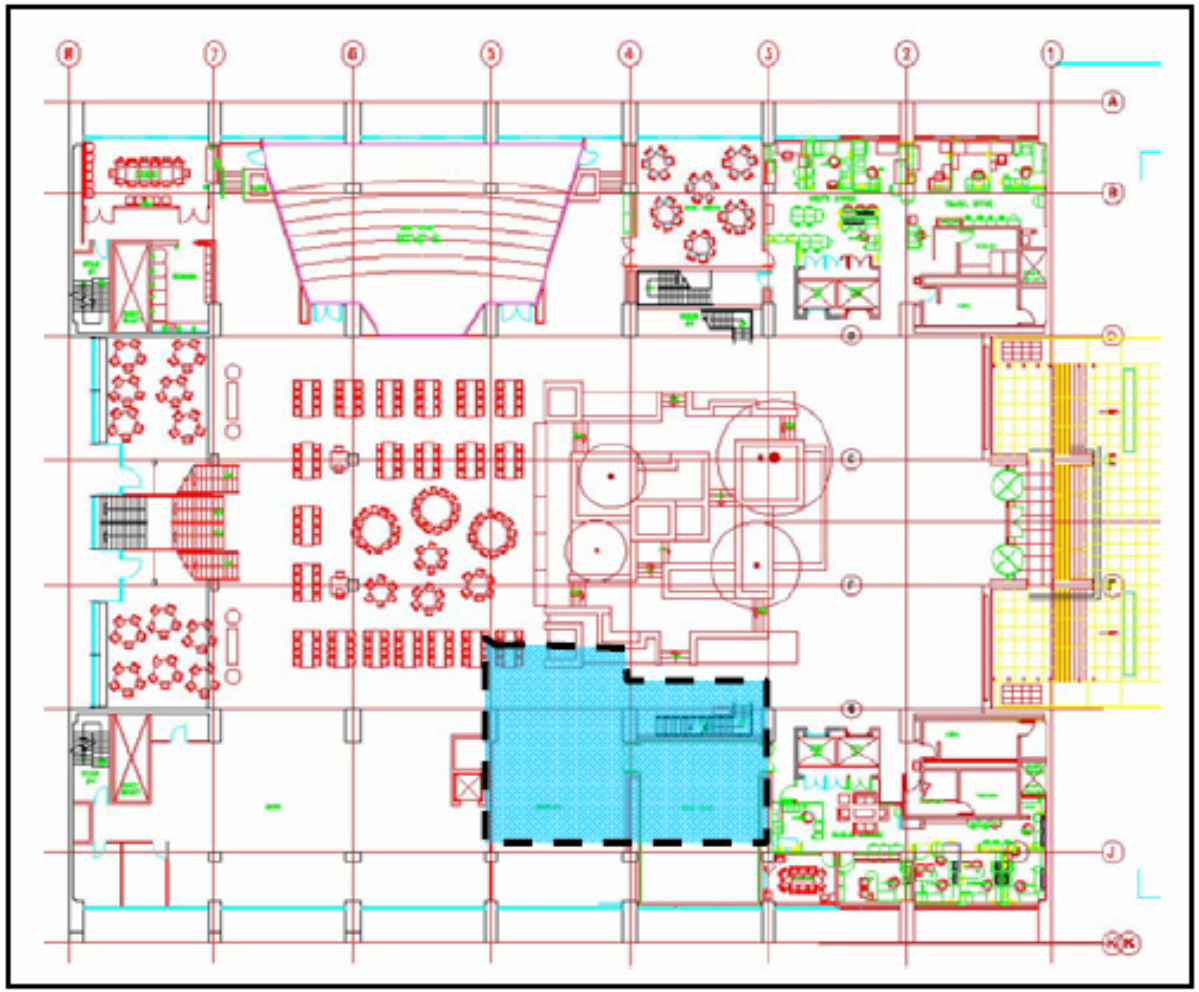
* Accelerator Subgroup

The LHC@FNAL task force had its last meeting on March 29, 2006.

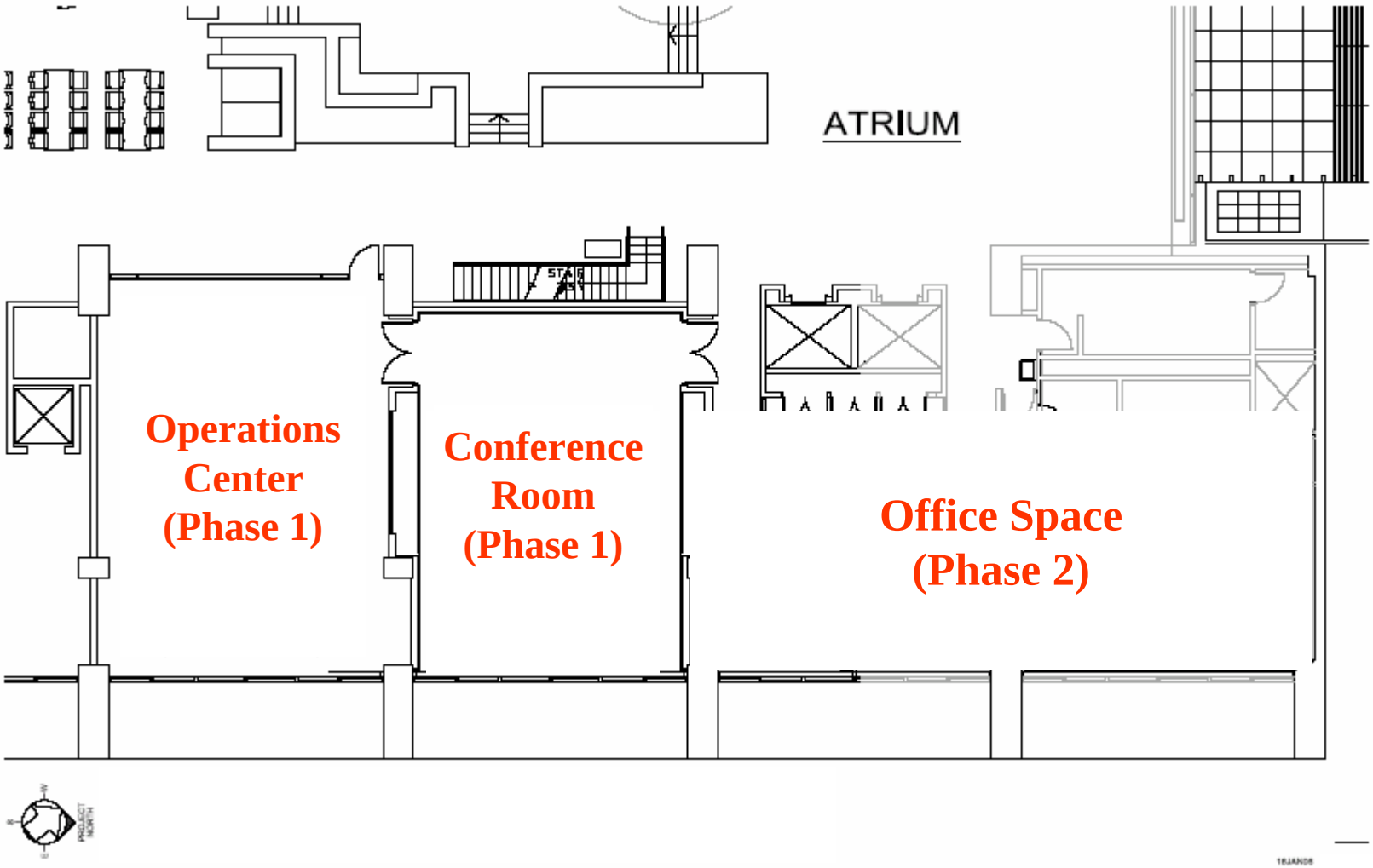
# Planning for LHC@FNAL

- The LHC@FNAL task force developed a plan with CMS collaborators. Most of our input came from CMS HCAL and tracker groups, with some input from CDF, D0, MINOS, and MiniBoone.
- We worked with CMS and US-CMS management, as well as members of LARP (LHC Accelerator Research Program) and LARP management at all steps in the process.
- A requirements document for LHC@FNAL was prepared and reviewed last summer.
- We visited 9 sites (e.g. Hubble, NIF, ESOC) to find out how other projects do remote operations.
- The goal is to have LHC@FNAL ready before the start of beam (end of 2006).

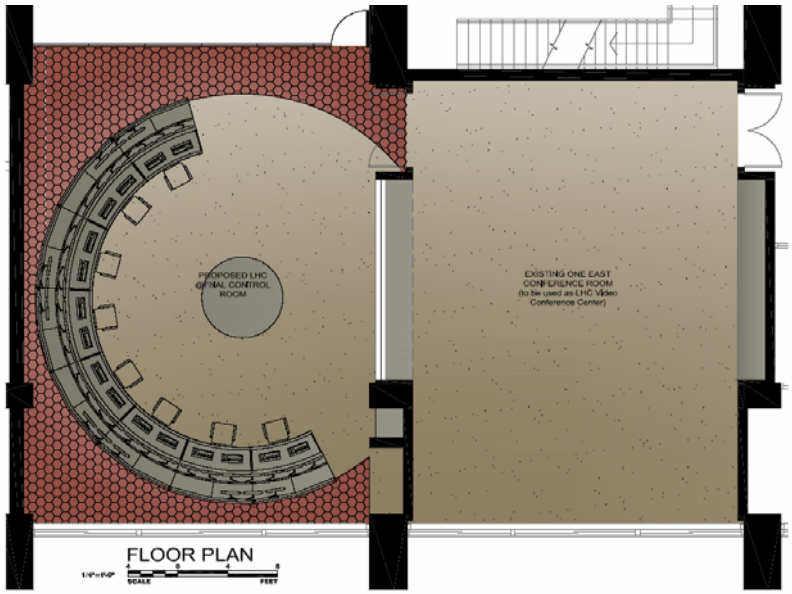
# LHC@FNAL – Floor plan

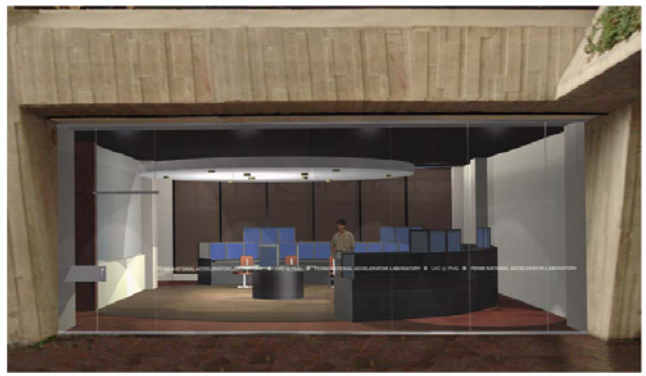


# New Location & Layout



# LHC@FNAL – renderings



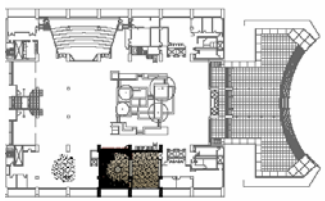



View of proposed control room - looking east from Atrium

View of existing conditions

View with projection on wall

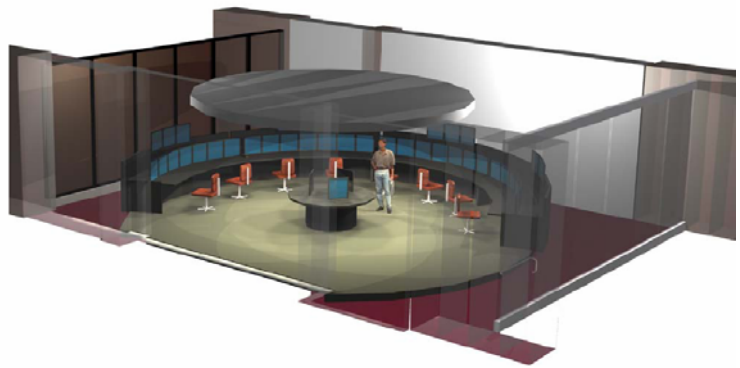
View with projection on glass



Atrium level key plan

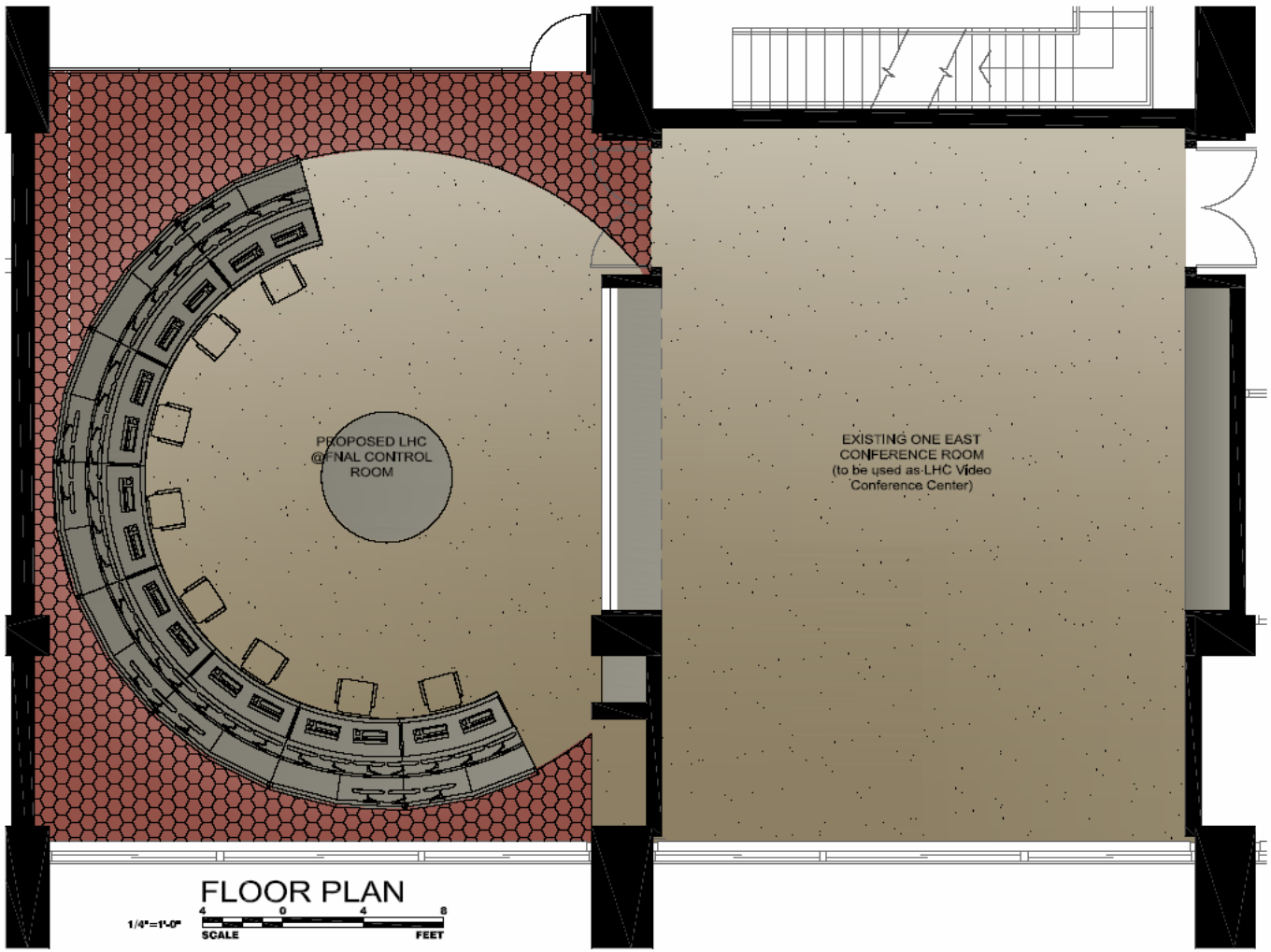
LHC @ FNAL
OPERATIONS CENTER

ATRIUM LEVEL PROPOSAL
April 25, 2006
FESS / Engineering

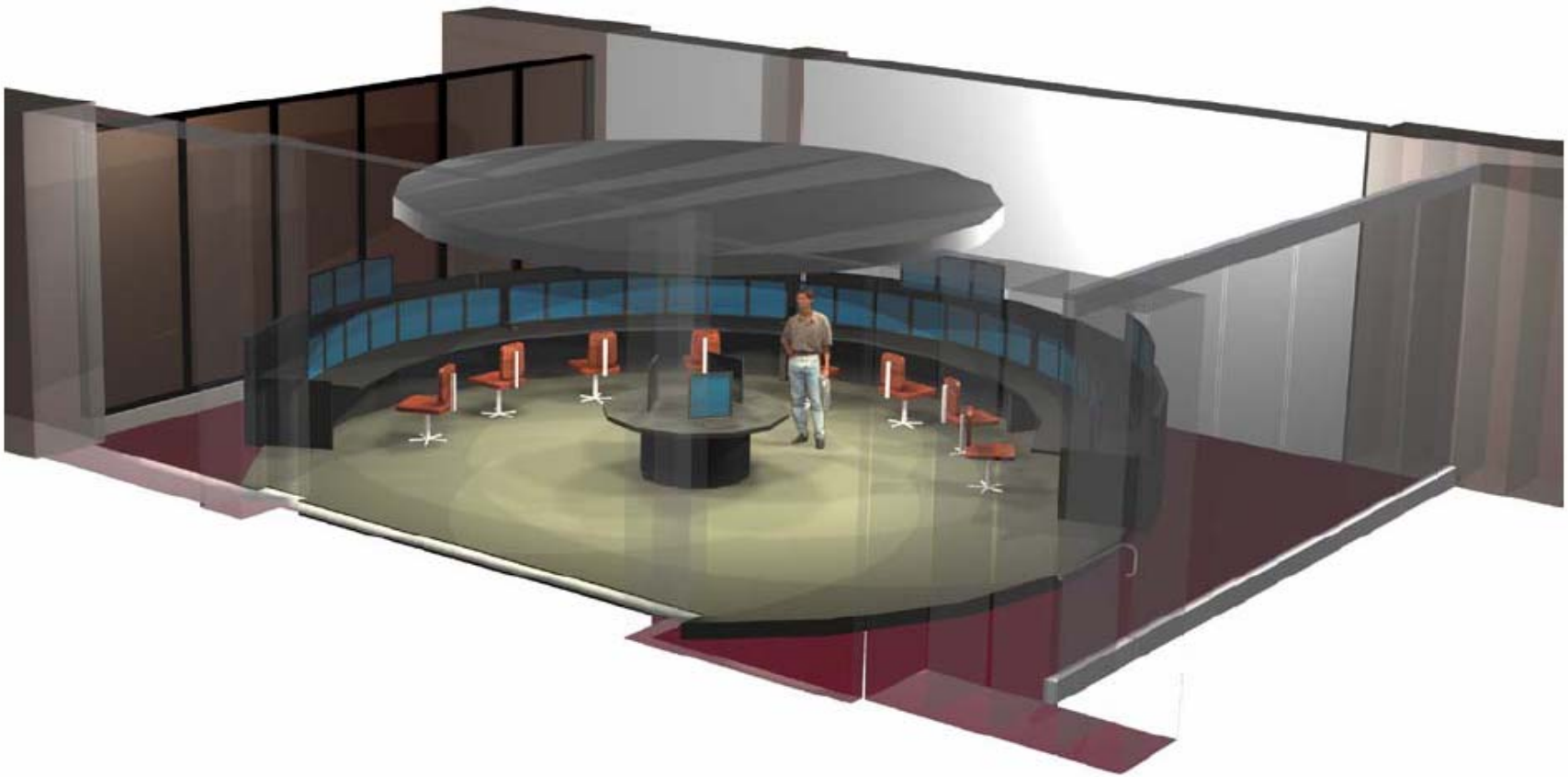


Isometric view of proposed control room

# LHC@FNAL – Floor plan



# LHC@FNAL – Isometric view



Isometric view of proposed control room


LHC @
FNAL


LHC @
FNAL

# Possible CMS Activities

## Operations Center:

- Online shifts (DQM, trigger monitoring)
- Offline shifts (data processing, data distribution, GRID)
- Miscellaneous (shift training, DB maintenance)
- Call center for US-CMS

## Conference Room (integrated with Ops. Center):

- Daily & weekly meetings

## Office Space:

- Two small meeting rooms (3 – 5 people each)
- Expert space
- Rest area for shifters

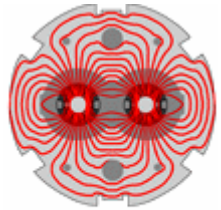
# Summary

We have developed the plans for a joint CMS and LHC remote operations center, and are working on finalizing the construction drawings.

We expect to begin construction by June 2006, and complete construction by October 2006.

We believe that LHC@FNAL will be a place that actively supports commissioning and operations of both the LHC and CMS, and will help to keep the HEP community actively engaged in activities at CERN.


# Additional Slides



LARP

# LHC@FNAL Current Status

- LHC@FNAL layout endorsed by Director Oddone
- Conceptual Design Report completed and reviewed
- Project Execution Plan completed and reviewed
- Project Managers
  - Elvin Harms (FNAL-AD) – construction
  - Erik Gottschalk (FNAL-PPD) – consoles
- Weekly meetings to prepare construction drawings
- Presentation to US-CMS Collaboration (early April)
- Presentation to LHC Accelerator Research Program (LARP) at its collaboration meeting (late April)
- Approval from DOE Office (May)
- “Lab-wide review” of construction drawings (May)

# Assumptions

## For CMS

- CMS will have a shift schedule, a run plan, and a protocol that defines responsibilities and roles of shift personnel. We assume that a shift leader is responsible for CMS shift activities.
- LHC@FNAL will have shift operators who will be able to assist US-CMS collaborators with CMS activities during commissioning and operations.
- LHC@FNAL will participate in CMS shifts. Neither the duration nor the frequency of the LHC@FNAL shifts has been determined.
- The CMS Collaboration will have a protocol for access to the CMS control system (PVSS), and a policy for how access to the control system will vary depending on the physical location of an individual user.
- The CMS Collaboration will have a policy that defines how DAQ resources are allocated. This includes allocation of DAQ resources to various detector groups for calibration and testing.
- The CMS Collaboration will have a protocol that defines how on-demand video conferencing will be used in CMS control rooms and LHC@FNAL.
- The CMS Collaboration will provide web access to electronic logbook and monitoring information to collaborators worldwide
- The CMS Collaboration will maintain a *call tree* that lists on-call experts worldwide for each CMS subsystem during commissioning and operations

## For both CMS & LHC

- LHC@FNAL will comply with all CERN and Fermilab safety and security standards.

# Site Visits

- **Technology Research, Education, and Commercialization Center (TRECC) – West Chicago, Illinois** (Aug. 25, 2005)
- **Gemini Project remote control room – Hilo, Hawaii** (Sept. 20, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=425
- **Jefferson Lab control room – Newport News, Virginia** (Sept. 27, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=505
- **Hubble Space Telescope & STScI – Baltimore, Maryland** (Oct. 25, 2005)
- **National Ignition Facility – Livermore, California** (Oct. 27, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=532
- **General Atomics – San Diego, California** (Oct. 28, 2005)
- **Spallation Neutron Source – Oak Ridge, Tennessee** (Nov. 15, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=570
- **Advanced Photon Source – Argonne, Illinois** (Nov. 17, 2005)
- **European Space Operations Centre – Darmstadt, Germany** (Dec. 7, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=622